



RWE Dea UK

Environmental Report 2010

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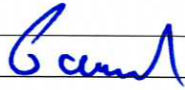
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RWE Dea UK

2010 Environmental Report

Notes:

Revision Record:

Rev.	Date Prepared	Author	Name	Title	Signed	Date App'd
1	13/06/11	H Roberts	R Pawel	Managing Director		16.6.11
0	10/06/11	H Roberts	-	-	-	-

Document Origination			Document Approval for RD Use			
The master signed original of this document is held by the RWE Dea Data Manager						

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Glossary

Centrica	Centrica Energy Upstream
CMS	Caister Murdoch System
DECC	Department of Energy and Climate Change
EEMS	Environmental Emissions Monitoring System
EIA	Environmental Impact Assessment
EMAS	Eco-management and Audit Scheme
EMS	Environmental Management System
EPC	Emergency Pollution Control Regulations 2002
ES	Environmental Statement
FOC	Fibre Optic Cable
HOCNF	Harmonised Offshore Chemical Notification Format
HQ	Hazard quotient
HS&EMS	Health Safety & Environment Management System
IOPP	International Oil Pollution Prevention
ISO	International Standards Organisation
MMO	Marine mammal observer
NFFO	National Federation of Fishermen's Organisations
Noble	Noble Drilling
NUI	Normally unattended installation
OCNS	Offshore Chemical Notification Scheme
OCR	Offshore Chemicals Regulations 2002
OPEP	Oil Pollution Emergency Plan
OPPC	Oil Pollution Prevention and Control Regulations 2005
OPRC	Oil Pollution Preparedness, Response and Cooperation Regulations 1998
OSPAR	Oslo Paris convention for the protection of the marine environment of the NE Atlantic
PLONOR	Pose Little Or No Risk
PON15	Petroleum Operations Notice 15
POSA	Processing and operating services agreement
ppm	Parts per million
RDUK	RWE Dea UK
SNS	Southern North Sea
SoSREP	Secretary of State's Representative
TD	Total Depth
TGT	Theddlethorpe Gas Terminal
UKCS	UK continental shelf
VOC	Volatile Organic Compounds
WTE	Waste to energy

1 Introduction

This document is the 2010 Environmental Report for RWE Dea UK (RDUK). The report is a public statement designed to:

- Identify RDUK and define the scope of its offshore activities;
- Summarise RDUK's Environmental Management System (EMS);
- State RDUK's environmental policy, goals, objectives and targets; and
- Provide a performance summary for 2010.

RDUK has had a combined Health, Safety & Environment Management System (HS&EMS) in place since its inception in 2002.

In November 2010 RDUK was awarded ISO 14001 certification by DNV. The certification covers the management of all RDUK exploration, drilling, development and production operations and is valid through to November 2013.

This document is the fifth annual RDUK Environmental Report to be issued as a public statement.

Following on from the above introduction, the remainder of this document comprises the following 4 Sections:

Section 2 - RDUK Scope of Activities: Provides details of RDUK and the scope of its offshore activities.

Section 3 - EMS Summary: Provides a brief description of the RDUK EMS.

Section 4 - Environmental Policy: Provides a brief description of RDUK's environmental policy, including the relevant environmental goals, objectives and targets that have been established for significant environmental aspects and impacts.

Section 5 - Performance Summary: Provides a summary of performance in relation to the environmental policy, goals, objectives, targets and any relevant legislative requirements.

2 Scope of RDUK Activities

This Section identifies RDUK and describes the scope of RDUK's activities during the 2010 reporting period.

2.1 Overview

2.1.1 RWE Dea AG

RWE Dea AG, headquartered in Hamburg Germany, manages the upstream activities of the oil and gas business of the RWE Group. The RWE Group is headquartered in Essen, Germany, and is one of Europe's largest energy corporations. During 2010 RWE Dea AG's activities included the exploration for and the development/production of oil and gas in Germany, the UK, Norway, Denmark and Egypt and, additionally, exploration activities in Algeria, Libya, Morocco, Mauritania, Ireland, Poland and Turkmenistan. In Germany RWE Dea AG also operates large subterranean storage facilities for natural gas.

2.1.2 RWE Dea UK

RWE Dea UK (RDUK) is the UK operating subsidiary of RWE Dea AG. RDUK maintains production, development, and exploration activities on the UKCS (UK Continental Shelf). RDUK has been awarded exploration licences in the 20th, 21st, 22nd, 23rd, 24th, 25th and 26th UK licensing rounds, some of them as operator.

During 2010, RDUK's principal producing interests were the RDUK operated Windermere, Cavendish and Topaz southern North Sea (SNS) gas fields. RDUK-operated development activities undertaken during 2010 included developing both the Breagh and the Clipper South SNS gas fields.

During 2010 non-operated production interests included the Victor, Anglia, Markham, Saturn, Mimas, Tethys and Minke SNS gas fields. Other non-operated interests included the development of the Devenick gas condensate field located in the northern North Sea and the Bedevere SNS gas field, as well as partnership in a range of exploration licences in the southern, central and northern North Sea and the Irish Sea.

The environmental performance associated with the production and development activities at the non-operated fields is outwith the scope of this report and will be detailed in separate public statements produced by the respective operators.

RDUK's head office is located at the below address:

4th floor
90 High Holborn
London WC1V 6LJ.
Tel: 020 7421 5510
Fax: 020 7421 5525.

RWE Dea UK SNS Limited² is the licensed operator of the Windermere field on behalf of the field owners (RWE Dea UK SNS Limited 60 percent, Noble Energy 20 percent and Venture North Sea Gas Ltd. 20 percent) and is therefore responsible for demonstrating compliance through appropriate and relevant interface documentation.



The Windermere platform is controlled, operated and maintained for production purposes by Centrica. Although an operator in their own right, in this instance, Centrica is acting as a contractor and are responsible for day to day production operations at Windermere. In a Processing and Operating Services Agreement (POSA), Centrica are contracted by RWE Dea UK SNS Limited to provide processing and operating services.

Tasks such as wireline operations, well intervention, drilling and workovers are planned and managed directly by RDUK. During 2010 a platform-based workover, involving the introduction of a foamer product into the W1 well, was commenced.

During 2010, 14,394,806 Nm³ of gas and 536 tonnes of condensate were produced via the Windermere platform.

2.2.1.2 Cavendish

The Cavendish platform, pictured opposite, is a gas-condensate producing NUI located in SNS Block 43/19a. The platform is tied back via a 47 kilometre 10 inch pipeline to the ConocoPhillips operated Murdoch host platform. The Cavendish platform is a fixed four-legged jacket that is visited on a routine basis to undertake maintenance operations. The Cavendish topsides facilities enable primary operational control from the Murdoch platform. The Murdoch platform is the main hub of the Caister Murdoch System (CMS). Incoming gas supplies are commingled at Murdoch before being landed onshore in the UK, via the CMS trunk line, at the Theddlethorpe Gas Terminal (TGT).



RWE Dea UK SNS Limited is the licensed operator of the Cavendish field on behalf of the field owners (RWE Dea UK SNS Limited 50 percent and Dana Petroleum Plc 50 percent) and is therefore responsible for demonstrating compliance through appropriate and relevant interface documentation.

The Cavendish platform is controlled, operated and maintained for production purposes by the contractor ODE Ltd. who is responsible for day to day production operations. In a services support role, ODE Ltd. are contracted by RWE Dea UK SNS Limited to provide processing and operating services. Tasks such as wireline operations, well intervention, drilling and workovers are

² RWE Dea UK SNS Limited is a 100 percent subsidiary of RDUK Holdings Limited.

planned and managed directly by RWE Dea UK SNS Limited. With a view to increasing their productivity, the C1 and C3 wells were worked over during 2010 using both wireline and coiled tubing interventions.

329,290,130 Nm³ of gas and 285 tonnes of condensate were produced via the Cavendish platform during 2010.

2.2.1.3 Topaz

The Topaz subsea well head and protective structure, pictured below during installation, is a gas producing seabed installation located in SNS Block 49/02a. The facility is tied back to the Tullow Oil operated Schooner host platform via a 15.2 kilometre 6 inch gas export line, with associated methanol feed line and control and communications cable. The Schooner platform is itself tied back to the Murdoch platform described above.



RWE Dea UK SNS Limited is the licensed operator of the Cavendish field on behalf of the field owners (RWE Dea UK SNS Limited 75 percent and Faroe Petroleum (UK) Limited 25 percent) and is therefore responsible for demonstrating compliance through appropriate and relevant interface documentation.

The Topaz subsea production facility is controlled, operated and maintained for production purposes remotely from Tullow Oil's Schooner platform. Tullow Oil have a contract in place with Petrofac Ltd., the Duty Holder and day to day operator of the Schooner platform.

110,949,222 Nm³ of gas and 7,689 tonnes of condensate were produced via the Topaz production facility during 2010.

2.2.2 Drilling

During 2010 RDUK contracted the Ensco 72 jack-up rig, pictured below, to undertake a back-to-back three-well drilling programme in the SNS. The Airidh exploration well, located in UKCS Blocks 42/19a, was drilled between May and June. The Macanta exploration well, located in UKCS 42/14, was then drilled between June and August.



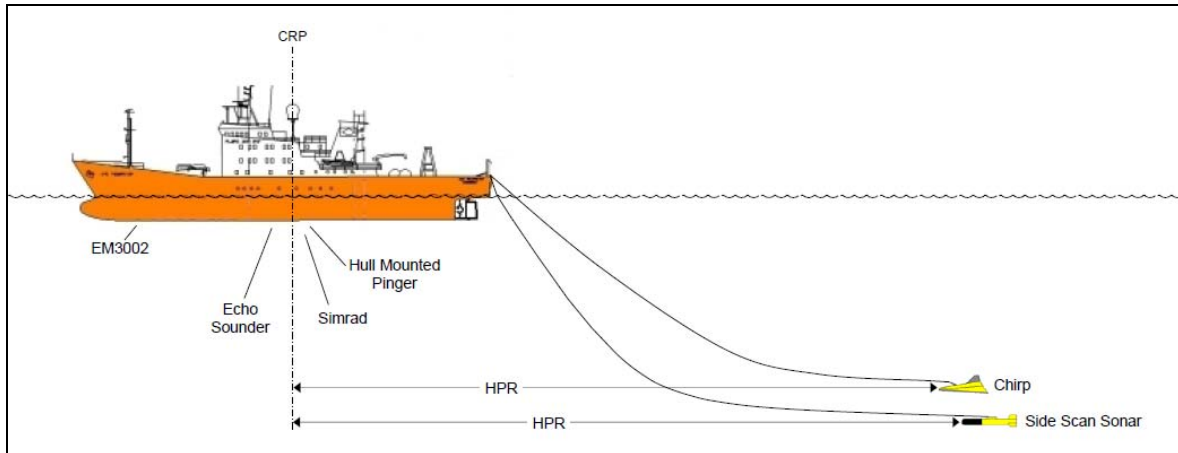
Thereafter, the Ensco 72 drilled the C2y development sidetrack well via the Cavendish platform's C2 well slot. The Ensco 72 rig arrived on location at the Cavendish platform in August. In addition to C2 well operations, the Ensco 72 was utilised to support workover operations on wells C1 and C3, as described in Section 2.2.1.2. The Ensco 72 rig was also utilised to permanently plug and abandon the non-producing reservoir section of the C2z wellbore before drilling,

completing, testing and commissioning the C2y sidetrack. The Ensco 72 rig transited away from the Cavendish platform in December en route to RDUK's Breagh East field where it commenced drilling operations in 2011.

2.2.3 Offshore survey

2.2.3.1 Site, pipeline-route and geotechnical borehole surveys

During 2010 various survey vessels were contracted in order to undertake site, pipeline-route and geotechnical borehole surveys at a range of locations within the vicinity of the greater Breagh field area.



Site surveys, incorporating detailed environmental workscopes, such as potential Annex I Habitat assessments, environmental baseline surveys and herring spawning ground surveys, were undertaken at the Airidh, Macanta and Breagh East fields in UKCS Blocks 42/19a, 42/14 and 42/13a respectively. The vessels and equipment used to acquire the survey data were similar to that pictured above.

Trained marine mammal observers and fisheries liaison officers were contracted to provide their services offshore as required.



Offshore and nearshore pipeline route surveys, also incorporating detailed environmental workscopes, were completed along the 100 km Breagh pipeline route between Block 42/13a and Teesside.

The Bucentaur geotechnical drilling vessel, pictured opposite, was contracted to acquire a 100 m deep geotechnical borehole at the Breagh Field.

2.2.3.2 Seismic survey

During 2010 the MV Amadeus, pictured below, was contracted to acquire 3D seismic survey data across UKCS Blocks 36/28, 36/29, 42/03, 42/04, 42/05.



Air Guns, with a total energy source volume 2,260 cubic inches, were used to acquire seismic survey data along 2,996 km of sail line covering an area of approximately 400 square km.

A trained marine mammal observer was contracted to provide coverage throughout the survey.

3 EMS Summary

This Section provides a brief description of RDUK's EMS.

3.1 Introduction

The EMS is the component of RDUK's overall Business Management System (BMS) that defines the organisational structure, planning activities, responsibilities, procedures, business processes and resources required for developing, implementing, achieving, reviewing and maintaining the environmental policy.

The RDUK EMS is a tool for identifying and managing the impact RDUK's business has on the environment. The EMS works to reduce this impact by controlling the quantity of materials and energy used and the amount of waste produced. As well as facilitating the management of environmental impacts in a credible way, the EMS provides a practical tool to help evaluate and improve performance in a verifiable way.

The following guiding principals and methodologies are incorporated into the OSPAR Strategy and integrated, as appropriate, into RDUK's EMS:

- the precautionary principle;
- the polluter pays principle;
- best available techniques and best environmental practice, including, where appropriate, clean technology;
- sustainable development;
- the application of an integrated ecosystem approach; and
- the waste management hierarchy of avoidance, reduction, re-use, recycling, recovery, and residue disposal.

3.2 Verification

RDUK has had an HS&EMS in place since its inception in 2002. In November 2010 RDUK's EMS was awarded ISO 14001 certification by DNV, an independent and accredited third party certification body possessing recognised competence in this field. The ISO 14001 certification covers the management of all RDUK exploration, drilling, development and production operations and is valid through to November 2013.

Prior to RDUK achieving ISO 14001 certification, an internal review was carried out in order to assess the EMS components of the RDUK HS&EMS against the ISO 14001 standard. The scope of the review comprised a 'system audit', reviewing HS&EMS system documentation against clauses within the ISO 14001 standard. A gap analysis was carried out and an action plan was developed which identified new documents that were required to meet identified specific gaps and some documents that required amendment.

In order to demonstrate conformity with the EMS requirements set out in OSPAR Recommendation 2003/5³ and the OSPAR Offshore Strategy⁴, independent verification of RDUK's EMS was initially gained in September 2006. Following on from this, a second

³ OSPAR Recommendation 2003/5 - to Promote the Use and Implementation of Environmental Management Systems by the Offshore Industry. Meeting of the OSPAR commission; Bremen: 23-27 June 2003

⁴ OSPAR Strategy on Environmental Goals and Management Mechanisms for Offshore Activities ("Offshore Strategy"-OSPAR Reference Number 2003-21) available on the OSPAR website <http://www.ospar.org/>

independent verification of RDUK's EMS was successfully completed in August 2008, to cover the 2008 to 2010 period. In both instances, verification was carried out by an independent and accredited third party certification body possessing recognised competence in the area.

3.3 Review

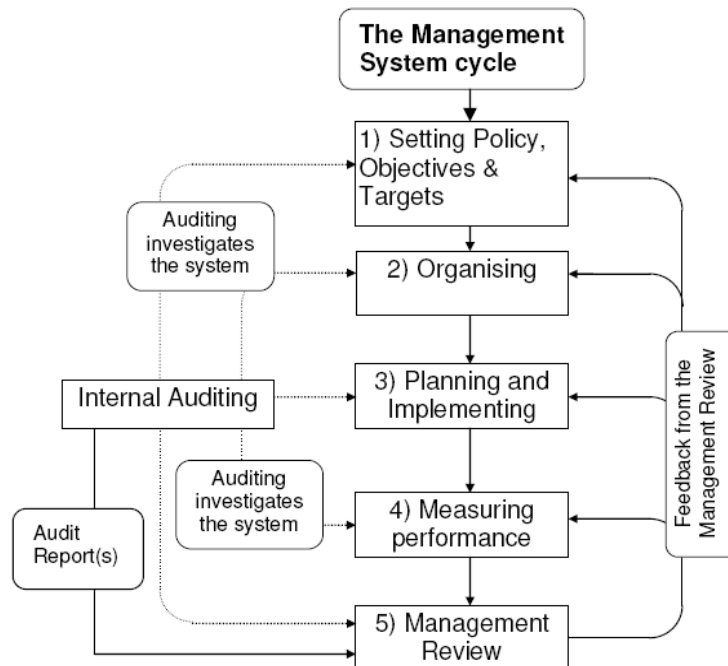
In order to assess the adequacy and suitability of the HS&EMS, internal system reviews have been conducted in 2005 and 2008 (RDUK references RD-COR-SRT005 and RD-COR-SRT011 respectively). The HS&EMS was again subject to review as part of the ISO 14001 certification process during 2010. Five minor comments relating to the ISO 14001 standard were identified in DNV's initial ISO 14001 audit report.

In addition to these reviews, a formal review of performance is conducted annually. This is an essential step required to assess the effectiveness of the HS&EMS in achieving the aims of RDUK's policy and objectives and to achieve continuous improvement in the control system.

The review process enables RDUK to:

- review progress against existing objectives and targets;
- consider evidence of performance, such as audits and other reports;
- consider the sufficiency of the organisational structure, the available resources, the policy and the management system in general; and
- agree new objectives and targets.

The RDUK Management System review process is illustrated in the figure below.



Internal auditing is used to objectively investigate how each element of the management system is being applied. Internal audit reports provide input to management review, along with other performance indicators.

4 Environmental Policy

This Section provides a brief description of RDUK's environmental policy, including relevant environmental goals, objectives and targets set for significant environmental aspects and impacts.

4.1 Introduction

With regard to the setting of environmental goals and the establishment of improved management mechanisms to achieve them, an objective of the OSPAR Commission is to:

'Prevent and eliminate pollution and take the necessary measures to protect the maritime area against the adverse effects of offshore activities so as to safeguard human health and to conserve marine ecosystems'.

In terms of pollution of the marine environment, the OSPAR Strategy has identified the following offshore activities as being of greatest concern which could include, *inter alia*:

- the use and discharge of Hazardous Substances⁵;
- the discharges of oil and other chemicals in water and from well operations;
- emissions of substances likely to pollute the air;
- flaring; and
- the disposal of naturally occurring radioactive material (NORM) in the form of low specific activity radioactive scales and sludge.

In line with the OSPAR Strategy, RDUK have established an environmental goal of protecting and conserving the maritime area against any potentially adverse effects resulting from its activities. To achieve this goal, RDUK have developed programmes and measures to identify/ prioritise/ monitor and prevent/ reduce/ eliminate any emissions, discharges or losses of substances which could cause pollution.

Non-polluting activities, that may have potentially adverse effects on the ecosystems and biological diversity of the maritime area, include exploration activities and the installation of structures, cables and pipelines.

4.2 RDUK HS&E Policy Statement

The components of the RDUK HS&E Policy Statement that relate to environmental management are stated in the remainder of this Section.

RDUK operates in a sensitive environment and takes a proactive stance in the protection of the environment. RDUK recognises its moral and legal obligations to conduct all its activities in a manner which protects the natural environment.

HS&E management is a prime responsibility of line management from the most senior executive to supervisory level. All employees are required to act responsibly so as to protect the environment.

⁵ Substances or groups of substances that are toxic, persistent and/or liable to bioaccumulate, or which give rise to an equivalent level of concern.

In relation to environmental management, RDUK will:

- annually set and internally publish objectives, seeking to achieve improvement wherever practicable;
- document procedures for management, based on recognised standards which clearly allocate responsibilities within RDUK's HS&EMS;
- provide and maintain clear lines of communication and consult with employees to ensure awareness and gain commitment to the policy and the company's procedures for its implementation;
- ensure that all employees are competent to discharge their relevant responsibilities and receive all necessary information, instruction and training;
- monitor and record performance, and conduct internal audits;
- annually conduct a management review of performance against objectives, including review and development of policy and the HS&EMS; and
- ensure that sufficient resources are provided and allocated to implement the policy.

For all its activities and projects undertaken, RWE Dea UK will:

- comply, as a minimum, with all environmental legislation applicable in the UK, applying best industry practice and undertaking steps to improve environmental protection levels where appropriate;
- plan for the management of environmental issues, identifying performance standards, procedures for control and monitoring, and resources to be applied;
- ensure that systematic hazard identification, assessment of the risk of harm and incorporation of measures to control risks are central to the design, construction and operation of facilities;
- select competent contractors and provide them with all necessary information, including definition of RDUK's HS&E requirements;
- monitor and audit contractors to ensure that they operate in compliance with the principles of RDUK's Policy and meet the standards required; and
- maintain emergency and contingency plans.

RDUK requires each of its contractors and suppliers to:

- operate an effective EMS relevant to their scope of work/supply; and
- comply with RDUK's environmental requirements including appropriate planning, hazard identification, risk control, performance monitoring and reporting.

4.3 Objectives and targets for 2010

The environmental management objectives and targets for the period between January and December 2010 are set out in an RDUK document entitled *Objectives and Targets for HS&E Management 2010 (Reference: RD-COR-SOT-010-1)*. The objectives were determined in order to progressively achieve the commitments set out in the HS&E Policy Statement. The environmental objectives and targets for 2010 are set-out in the next section in Table 5.1 along with the associated progress status.

5 Performance Summary

This Section provides a summary of performance in relation to compliance with relevant legislative requirements and compliance with RDUK's environmental policy, goals, objectives and targets. A summary of the RDUK's offshore environmental aspects and their associated emissions and impacts is also provided.

5.1 Introduction

RDUK's internal and external auditing processes have enabled RDUK to report on the areas of environmental performance defined in Section 4, i.e. the extent to which the environmental goals listed below have been achieved:

- compliance with legislation;
- progress made in achieving environmental goals; and
- continual improvement in environmental performance.

The HS&E management review for 2010 was completed by the Head of QHSE during February 2010. The findings were presented to senior management and the accompanying RDUK report, entitled *HS&E Annual Report for 2010 (Reference: RD-COR-SRT018-1)*, was subsequently approved by the Managing Director in March 2010.

5.2 2010 environmental performance summary

Progress against the items identified in *Objectives and Targets for HS&E Management 2010* is shown in Table 5.1 below.

Table 5.1 - Objectives and targets for environmental performance during 2010

EMS Development	
Maintain the HS&EMS	Achieved
Training	
Maintain office induction training for all London office personnel	Achieved
Maintain emergency response team training needs	Achieved
Undertake Secretary of State's Representative (SoSREP) Exercise	Achieved
Operated Installations	
Zero reportable environmental incidents on all operating installations during production	Achieved
Exploration and developments	
Zero reportable environmental incidents during exploration & development, inc. drilling	Achieved ⁶
Audit and Review	
Prepare and publish Annual Environmental Report for 2009	Achieved
Attain ISO 14001 certification for the UK business	Achieved
Conduct annual HS&E Management Review for 2010	Achieved

⁶ The objective of zero reportable environmental incidents during 2010 was achieved. However, an OPPC Permit Non-compliance Notification Form was submitted to DECC after the total amount of reservoir hydrocarbons discharged with produced fluids in association with the permanent abandonment of the C2z well exceeded the maximum amount permitted in Term Permit Application T00966.01 (Schedule 7b) by 0.86 kg. See Notification Form for the details, the cause and the steps taken to prevent re-occurrence.

In the following Sections, RDUK's environmental performance is assessed against the following three categories of offshore activity (as utilised in Section 2):

- Production and well workover (Windermere, Cavendish and Topaz fields)
- Drilling (Airidh, Macanta and Cavendish fields)
- Survey (Airidh, Macanta, Breagh and Darach fields)

5.2.1 Production and workover

RDUK production operations during 2010 were limited to the production operations associated with the Windermere, Cavendish and Topaz fields. During 2010 a platform-based workover, involving the introduction of a foamer product into the Windermere W1 well, was commenced. With a view to increasing their productivity, the Cavendish C1 and C3 wells were worked over during 2010 using both wireline and coiled tubing interventions.

5.2.1.1 Chemical use and discharge

For the Cavendish facilities, production chemicals are supplied via Murdoch and remain in a closed system that originates and terminates onshore at TGT. As such, the use and/or discharge of these chemicals does not require permitting under the Offshore Chemical Regulations 2002 (OCR) via a PON15D. Furthermore, the OCR effectively exempts the following: products used solely within accommodation areas, chemicals used to prevent machinery or installation corrosion, additives to potable water systems, paints and other coatings, fuels, lubricants, fire-fighting foams and hydraulic fluids that are only discharged in an emergency. As such, there are no chemicals used in association with routine production operations at Cavendish that are required to be permitted under the OCR via a PON15D permit.

Approximately 2 tonnes of Castrol Transaqua HT2, a water-based hydraulic fluid with an Offshore Chemical Notification Scheme (OCNS) category D ranking, was discharged via the Topaz facility. The use and discharge of this product is permitted under the OCR on the PON15D Chemical Permit for the Tullow Oil operated Schooner platform.

265 kilograms of a corrosion inhibitor product, Cortron CK987-G, was used in association with routine production operations at Windermere during 2010. Cortron CK987-G is flagged for substitution due to three of its components which are surface active and toxic. These contribute to about 14% of the final formulation of the product. All of these components show a moderate degree of biodegradation (20-60%). Because of their surface activity, they are assumed to bioaccumulate under the precautionary principle and this has caused them to receive a substitution warning. In addition to the corrosion inhibitor product, 200 kilograms of a defoamer product, Cap Foam HT E, was used in association with a well stimulation operation that was commenced at the Windermere platform during 2010. Cap Foam HT E contains a component that has been deemed to be a candidate for substitution on account of the fact that a fatty amine surfactant component drives the worst case HQ. However, neither the corrosion inhibitor nor the defoamer was discharged into the UKCS marine environment. Small fractions of these products may be discharged with produced water at Centrica's J6-A platform located in the Dutch sector of the North Sea. In compliance with the OCR, up-to-date and valid PON15D/F chemical permits was maintained throughout 2010 to cover the use of these chemicals both of which have valid HOCNF status and are approved for offshore use under the OCNS. Throughout 2010 Environmental Emissions Monitoring System (EEMS) returns, confirming the quantities of all chemicals used and/or discharged were submitted.

Three PLONOR⁷ listed chemicals, methanol, potassium chloride and MEG, were used in conjunction with the workover of the Cavendish C1 and C3 wells. The amount of each of these chemicals that was used, and then discharged, is shown in Table 5.2. A Gold ranked cleaning fluid was also used onboard the jack-up rig that was attending the platform and supporting the workover operations.

Table 5.2 - Chemical use/discharge at Windermere, Cavendish and Topaz during 2010

Chemical name	Function	OCNS / HQ rank	PLONOR	SUB label	2010 use (kg)	UKCS discharge
Cortron CK987-G	Corrosion inhibitor	Gold	No	Yes	265	No
Cap Foam HT E	Defoamer	Gold	No	Yes	200	No
Methanol	Gas hydrate inhibitor	E	Yes	No	348	Yes
Potassium chloride	Coiled tubing fluid	E	Yes	No	3,125	Yes
MEG	Gas hydrate inhibitor	E	Yes	No	26,615	Yes
Sobo S Gold 08	Cleaning fluid	Gold	No	No	584	Yes
Castrol Transaqua HT2	Hydraulic fluid	D	No	No	2,000 ⁸	Yes

5.2.1.2 Produced water discharges

The produced fluids generated in association with production operations at Windermere include gas, condensate and produced water. The produced water is separated from the rest of the production flow at the Centrica operated Markham J6-A platform located in the Dutch sector. This produced water is then treated in order to remove the majority of the residual dispersed oil content⁹ before being discharged to sea. 104.2 cubic metres of water were produced from the Windermere field during 2010. This produced water is exported, along with the other produced fluids from the Windermere field, via the Centrica operated ST-1 platform located on the UKCS, and on to the Centrica operated J6-A platform located in the Dutch sector. Several produced fluid streams, including flow from both the UK and Dutch sectors, arrive at the J6-A platform prior to separation, commingling and, in the case of the produced water stream, treatment. A separate measurement of the hydrocarbon concentration of the treated produced water stream originating from Windermere is not made. However, if it is assumed that each of the produced fluid streams arriving at J6-A contributes an equal amount of hydrocarbons to the treated and commingled produced water stream that is discharged, an estimate of the amount of aliphatic and aromatic hydrocarbons discharged into the marine environment as a result of production operations at Windermere during 2010 can be made. Based on this assumption, approximately 1.5 kilograms of aliphatic hydrocarbons and 16.0 kilograms of aromatic hydrocarbons originating from the Windermere field were discharged with produced water during 2010.

The Cavendish and Topaz developments utilise completely closed production systems. There are no separation facilities or disposal caissons at Cavendish, Topaz or Murdoch and all produced fluids are routed onshore to TGT. As such, there are no offshore discharges of produced water associated with production operations at either Cavendish or Topaz.

5.2.1.3 Waste

A total of 0.45 tonnes of waste was generated at the Windermere platform during 2010. This comprised 0.18 tonnes of oils (incinerated) and 0.27 tonnes of sludges/liquids/tank washings (incinerated).

⁷ PLONOR listed products are considered to Pose Little Or No Risk to the environment.

⁸ Approximate estimated use/discharge amount

⁹ The dispersed oil content refers to the quantity of aliphatic hydrocarbon chains dispersed within the produced water, as distinct from the dissolved aromatic hydrocarbon content.

A total of 4.77 tonnes of waste was generated at the Cavendish platform during 2010. This comprised 2.47 tonnes of segregated recyclables (recycled), 0.80 tonnes of sludges/liquids/tank washings (incinerated) and 1.50 tonnes of general waste (landfill).

In addition to the above wastes, the liquid waste generated at the Cavendish, Windermere and Schooner¹⁰ platforms during routine maintenance visits by the contracted flying squads was limited to small volumes of wastewater, from the sink and shower as well as sewage from the single toilets, discharged to sea. The small amounts of domestic waste generated during platform visits is bagged and returned onshore.

RDUK policy states that no garbage, including plastics, is to be disposed of overboard.

5.2.1.4 Atmospheric emissions

There are no generators or turbines onboard the Windermere platform or at the Topaz subsea facility and therefore no associated atmospheric emissions occurring at either of these installations. Electrical power is supplied to the Windermere platform via cable from the ST-1 platform and to the Topaz subsea facility via cable from the Schooner platform. Extrapolation of available data suggests that 845,618 m³ of the gas produced from Windermere was burnt as fuel gas and that 9,153 m³ was released as vent gas in order to facilitate the safe transport of gas from the point of production at Windermere, via the offshore host platform (Markham J6-A) and onshore gas processing plant (Den Helder), to the point of sale.

Power onboard the Cavendish platform is provided by a diesel generator. 54.0 tonnes of diesel were burnt onboard the Cavendish platform during 2010. The approximate quantities of atmospheric emissions resulting from the combustion of this amount of fuel were 173 tonnes of carbon dioxide, 3.2 tonnes of nitrogen oxides, 0.01 tonnes of nitrous oxide, 0.22 tonnes of sulphur dioxide, 0.85 tonnes of carbon monoxide, 0.01 tonnes of methane and 0.11 tonnes of VOC. Direct gas releases from the Cavendish platform during 2009 comprised 0.96 tonnes of maintenance venting (including 0.09 tonnes of carbon dioxide, 0.70 tonnes of methane and 0.11 tonnes of VOC) and approximately 0.49 tonnes of fugitive emissions (including 0.05 tonnes of carbon dioxide, 0.38 tonnes of methane and 0.06 tonnes of VOC). Data detailing the significant amount of fuel and any flare gas consumed at the offshore host platform (Murdoch) and the onshore gas terminal (TGT) during 2010, in order to transfer Cavendish gas to the point of sale, have not yet been made available by ConocoPhillips. Accurate estimates of the associated vent gas volumes cannot be deduced as they are lost within the shrinkage volume¹¹. However, ratios of fuel and vent gas that are approximately similar to those described for the Windermere platform can be expected to apply.

Atmospheric emissions relating to production operations at the Cavendish, Windermere and Topaz fields were also generated as a result of the combustion of fuel onboard the helicopters and supply/guard vessels utilised during planned maintenance visits.

5.2.1.5 Oil spills

RDUK have Oil Pollution Emergency Plans (OPEP's) in place to cover all production operations at both Cavendish and Windermere. The spill arrangements for the Topaz subsea facility are detailed within an Addendum of Tullow Oil's OPEP for the Schooner platform. Each OPEP lists the required offshore and onshore actions and responses, defines roles and responsibilities in the event of an oil spill and provides a risk assessment.

¹⁰ Waste that's applicable to the Topaz subsea tieback.

¹¹ Volumetric 'shrinkage' is associated with the removal of condensate between the wet and dry gas phases.

Each of the Cavendish, Windermere and Schooner OPEP's has been approved under the Emergency Pollution Control (EPC) Regulations 2002 and the Oil Pollution Preparedness, Response and Cooperation (OPRC) Regulations 1998. No oil spills occurred at or in association with any of the RDUK production facilities during 2010.

5.2.2 Drilling

RDUK's drilling operations during 2010 comprised a 3-well back-to-back SNS campaign undertaken utilising the Ensco jack-up rig. The Airidh and Macanta exploration wells were drilled in Blocks 42/19a and 42/14 respectively. Thereafter the suspended Cavendish C2z well was permanently abandoned and the Cavendish C2y sidetrack well was drilled. Helicopters and a number of vessels, including supply vessels, emergency response and rescue vessels, and tugs, were used to support the drilling operations.

Prior to contract award, RDUK ensured that the various rig, helicopter and vessel contractors had suitable systems, procedures and interface documentation in place to link the contractors management systems with RDUK's, thus enabling RDUK's EMS principles, environmental policy and relevant environmental goals, objectives and targets to be managed.

5.2.2.1 Chemical use and discharge

In compliance with the OCR, PON15B chemical permits were approved by DECC and maintained throughout all well operations. A record of chemical use and discharge during the course of all operations covered by a PON15B permit was maintained. All applicable chemicals used in conjunction with well operations had valid Harmonised Offshore Chemical Notification Format (HOCNF) status and were approved for offshore use under the OCNS. The amounts of chemicals used and discharged are shown in Table 5.3 below.

Table 5.3 - Chemical use and discharge during pipeline installation operations (tonnes)

Risk level	Justification for assigned risk level	Used	Discharged
Environmentally benign	PLONOR listed ¹²	5,487	4,256
Low risk	OCNS Category E or HMCS Gold HQ ¹³	2,300	1,679
Increased risk	OCNS Category D+ or HMCS Gold HQ+	20.6	0.53
Total		7,807	5,936

The chemicals have been grouped according to their risk categories. In terms of tonnage used, 70 percent of chemicals belong to the 'Environmentally benign' category identified in the first row of Table 5.3, 29 percent belong to the 'Low risk' category and 0.3 percent belong to the 'Increased risk' category. In terms of tonnage discharged, 72 percent of chemicals belong to the 'Environmentally benign' category, 28 percent belong to the 'Low risk' category and 0.009 percent belongs to the 'Increased risk' category. 12 of the products used contained components marked for substitution¹⁴. Of the products marked for substitution, 43.8 tonnes were used and 3.9 tonnes were discharged.

Qualitative and quantitative risk assessments relating to the use and discharge of each of the products described in this paragraph, along with a description of the replacement strategies the

¹² PLONOR listed products are considered to Pose Little Or No Risk to the environment.

¹³ As per the OCR, OCNS category 'E' products and products with a Harmonised Mandatory Control System (HMCS) Gold Hazard Quotient (HQ) are the categories deemed to have the lowest environmental impact.

¹⁴ Components are marked for Substitution on account of one or more of the following three properties: rate of biodegradation, acute toxicity and potential to bioaccumulate.

suppliers are employing, were provided in the respective PON15B Chemical Permit Applications and RDUK's associated Annual Technical Justification Report for 2010¹⁵ respectively.

No PON15B Permit Condition Non-Compliance Notification forms were submitted to DECC in association with RDUK's well operations during 2010 and no accidental releases of chemicals occurred in association with well operations.

5.2.2.2 Waste

In line with the concomitant PON15B Directions issued by DECC, approximately 1,712 tonnes of cuttings were discharged to sea/ the seabed in association with RDUK well operations during 2010. 138 tonnes of OBM and cuttings were back-loaded to shore where the solids (84.6 tonnes), oil (14.9 tonnes) and water (38.3 tonnes) were sent to landfill, re-used and treated respectively.

A total of 656 tonnes of Group I Special Waste was generated onboard the Ensco 72 during 2010. A breakdown of the types of Special Waste and their disposal categories is as follows:

- 51.4 tonnes chemicals/paints (0.08 recycled, 2.8 WTE¹⁶, 7.12 to landfill and 41.4 treated);
- 1.3 tonnes of drums/containers (1.22 recycled and 0.08 to landfill);
- 11.4 tonnes of oils (waste to energy);
- 6.7 tonnes of miscellaneous special waste (3.16 WTE, 0.8 to landfill and 2.74 treated);
- 586 tonnes of sludges/liquids/tank washings (treated)

A total of 133 tonnes of Group II General Waste was generated onboard the Ensco 72 during 2010. A breakdown of the types of General Waste and their disposal categories is as follows:

- 0.14 tonnes of drums/containers (recycled) ;
- 47.0 tonnes of scrap metal (recycled);
- 23.3 tonnes of segregated recyclables (recycled); and
- 62.4 tonnes of general waste (landfill).

In addition, 0.02 tonnes of clinical waste was incinerated.

Prior to the commencement of drilling activities, RDUK ensured that an appropriate Garbage Management Plan was in place for the Ensco 72 jack-up drilling rig. Ensco is responsible for ensuring compliance with all waste disposal licences and waste transfer documentation requirements for scrap metal and non-hazardous waste. Reuse or recycling is RDUK's preferred option. RDUK policy states that no garbage, including plastics, is to be disposed of overboard. Only comminuted food waste and sewage is to be discharged. The various support vessel contractors were responsible for ensuring compliance with all waste disposal licences and waste transfer documentation requirements.

5.2.2.3 Atmospheric emissions

Various vessels, including the Ensco 72 jack-up drilling rig, supply boats, a standby vessel, tugs and helicopters were used in association with well operations during 2010.

¹⁵ The Use of Term Permit Chemicals Identified as Chemicals for Priority Action or Marked for Substitution, RDUK reference RD-COR-SRT019-1.

¹⁶ Waste to energy

1,985 tonnes of diesel was burnt onboard the Ensco 72 in association with well operations during 2010. The approximate quantities of emissions resulting from the combustion of this amount of fuel were: 6,353 tonnes of carbon dioxide, 118 tonnes of nitrogen oxides, 0.44 tonnes of nitrous oxide, 7.93 tonnes of sulphur dioxide, 31.2 tonnes of carbon monoxide, 0.36 tonnes of methane and 3.97 tonnes of volatile organic compounds (VOC).

A total of 2415 tonnes of gas was combusted during the well testing and well clean-up operations. The approximate quantities of emissions resulting from the combustion of this amount of gas were: 6,761 tonnes of carbon dioxide, 2.9 tonnes of nitrogen oxides, 0.20 tonnes of nitrous oxide, 0.03 tonnes of sulphur dioxide, 16.2 tonnes of carbon monoxide, 108.7 tonnes of methane and 12.1 tonnes of VOC.

A comparatively small quantity of diesel would have been combusted onboard the support vessels, adding a comparatively small fraction to the atmospheric emissions identified above.

5.2.2.4 Oily water discharges and oil spills

In accordance with MARPOL 73/78 Annex 1, oily drainage water generated onboard both the Ensco 72 jack-up rig and the contracted support vessels was collected and treated to provide an effluent with a maximum oil in water content of 15 ppm.

A total of 1.81 kilograms of dispersed oil was discharged with produced fluids at a concentration of less than 30 mg/l in association with C2 well operations at Cavendish.

Throughout all well operations, the rig and support vessel contractors maintained approved Shipboard Oil Pollution Plans (SOPEP's).

No oil spills occurred during well operations.

5.2.3 Survey

Given quantities of both waste and atmospheric emissions would have been generated by the various site, pipeline-route, geotechnical borehole and seismic survey vessels contracted by RDUK during 2010. However, direct records of the amount of waste and atmospheric emissions generated by contracted survey vessels are not normally maintained by RDUK.

A trained marine mammal observer (MMO) was contracted to provide coverage throughout the survey. The MMO report, detailing the soft-start procedure used, visibility, observation effort, sightings, etc. has been submitted to the Joint Nature Conservation Committee.

In accordance with MARPOL 73/78 Annex 1, oily drainage water generated onboard the contracted survey vessels would have been collected and treated to provide an effluent with a maximum oil in water content of 15 ppm. Furthermore, all survey vessel contractors would have maintained approved Shipboard Oil Pollution Plans (SOPEP's).